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The Van Rysselberghe Telephonic System.

BY J. BANNEUX.

(*Concluded from page* 41.)

SIMULTANEOUS TELEGRAPHY AND TELEPHONY.

By applying to a telegraph wire the principle shown in Fig. 5, the duplex installation in Fig. 6 is obtained. In this case the graduating condenser C_1 has a capacity of 0.5 microfarad and, if need be, of 0.1 microfarad only; and the separating condenser C_2 has a capacity of 2 microfarads. In this way the independence of the two modes of communication is realized.

The anti-induction methods of M. Van Rysselberghe have been tried at various times on the Belgian telegraphic lines with the most complete success. We will mention particularly the already old experiment in which three operators stationed respectively at the Brussels Observatory, at Ostend, and at Antwerp, conversed with each other without difficulty over an iron wire of 4 millimetres, laid on the poles of the line connecting these places, and this, during the most active period of working of the numerous Morse and Hughes wires running parallel with the speaking wire, of which wires only a few, the most noisy, had been equipped with the anti-induction devices. The distance between Ostend and Antwerp is 170 kilometres. The telephonic transmitters and receivers used were designed by M. Van Rysselberghe for reproducing the voice with remarkable loudness, in such a way as to entirely overpower the disturbing noises, which had been purposely allowed free play. We will also note the telephonic transmission, in regular service, from the Palais

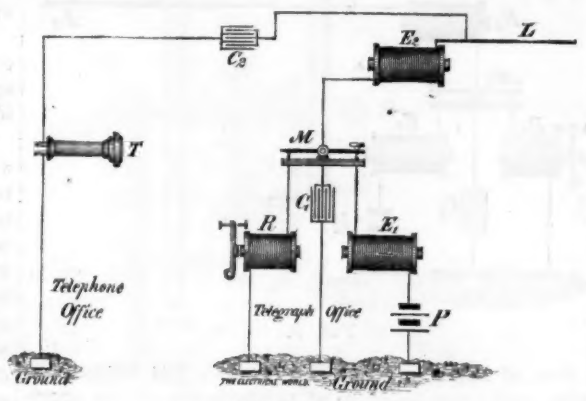

FIG. 6.

all that is said on one wire is clearly understood on all the others. The worst enemy of the telephone is no longer the telegraph, but the telephone itself. Therefore, whenever several telephonic circuits are needed between two given points it will be necessary to double the telegraph wires, which will, moreover, retain separately their ordinary adaptation. M. Van Rysselberghe proposes the two following solutions:

FIRST SOLUTION (Fig. 8.)

In this arrangement L_1 and L_2 represent the two telegraph lines looped together at a terminal station. S_1 and S_2 represent resistances of at least 900 ohms, R_2 a relay of a resistance of 7,000 ohms or more, and E and E_2 an electro-magnet of about 7,000 ohms. The condition $S \times L_2 = S_2 \times L_1$ is otherwise to be satisfied. From the telephonic point of view it is preferable to use electro-magnets for E S_1 S_2 in order that this condition of equilibrium may not need to be fulfilled so precisely.

FIG. 8.

SECOND SOLUTION (Fig. 9).

L_1 and L_2 are telegraphic wires, E_1 E_2 E_3 and E_4 electro-magnets of 900 ohms, C_1 and C_2 condensers of 0.5 microfarad capacity, C_3 and C_4 condensers of 2 microfarads, R_1 and R_2 telegraphic relays whose resistance is below 500 ohms.

It is the latter combination which has been applied in Belgium on the line between Brussels and Antwerp, between Haeren and Berchem (35 kilometres) and in Holland, between Amsterdam and Haarlem (18 kilometres).

Wherever it is desirable to utilize an international telegraph wire for telephonic service, or merely to prevent it from disturbing telephonic communication over other wires of the same line, it is not necessary that the wire should be equipped specially on that portion which is on foreign ground. It is sufficient to introduce an electro-magnet of 500 ohms into the circuit at the point where the wire crosses the dividing line between the two countries, or at any suitable intermediate point, and to place a condenser of 2 microfarads in a shunt to the ground at this point.

It is needless to insist on the necessity of insulating with the greatest care, in all duplex installations, the connecting wires and instruments of the telephonic stations in order to avoid interference between the telegraphic impulses, or to avoid losses to the ground.

The condensers require particular attention, for they must be capable of withstanding the action of the greatest difference of potential produced by the strongest batteries employed in telegraphy. For this purpose they are submitted, with the lightning arresters, to the following test: A circuit being formed comprising a battery of 300 Leclanché cells, three electro-magnets of 900 ohms each and a rapidly-vibrating current breaker to the binding posts of which are connected the coatings or armatures of a condenser, forming a derived circuit around the break, and itself shunted by a lightning arrester, the condenser is required to withstand without damage the extra currents thus produced. However, in the event of accidental injury, it is necessary to so arrange matters that the condensers and lightning arresters may be replaced by a mere turn of the hand.

It remains to describe the mode of connection between the entirely metallic circuits of the intra-urban lines and the

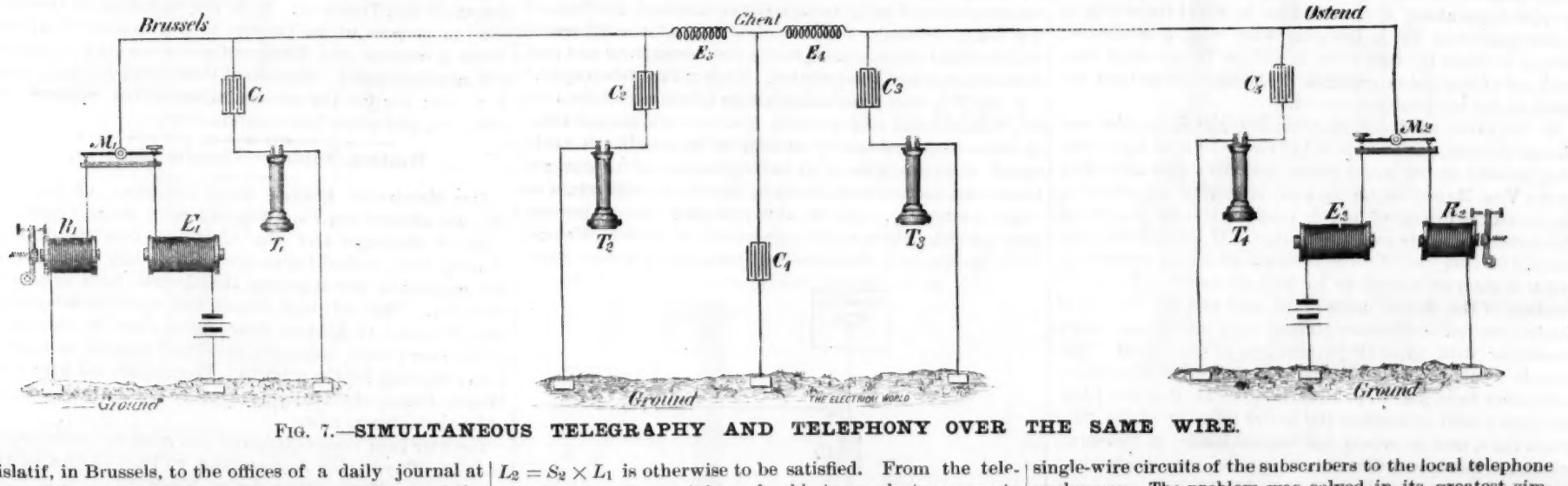

FIG. 7.—SIMULTANEOUS TELEGRAPHY AND TELEPHONY OVER THE SAME WIRE.

Legislatif, in Brussels, to the offices of a daily journal at Ghent, of the report of the parliamentary debates, of the exchange and market quotations, over an aerial wire of the telephonic line from Brussels to Ostend, which serves at the same time for the transmission of voltaic currents operating the Van Rysselberghe telemeteorographs located in the observatories of these two cities. The latter application is an example of the resources afforded by the system adopted for securing the mutual independence of two services by means of a single conducting wire. Two stations, *A* and *D*, can communicate with each other by telegraph while two other intermediate stations, *B* and *C*, communicate by telephone over the wire connecting the first two stations. What is better still, nothing prevents our dividing a continuous telegraphic wire into telephonic sections in such a manner as to multiply the number of stations placed in communication (Fig. 7). E_3 E_4 are coils or, preferably, electro-magnets of about 900 ohms, E_1 and E_2 electro-magnets of 1,000 ohms, R_1 R_2 telegraph relays of at least 900 ohms, and C_1 . . . C_5 condensers of 0.9 microfarads. Under these conditions T_1 and T_2 in one "section," and T_3 and T_4 in the other, communicate by telephone, while at the same time the terminal stations R_1 R_2 exchange telegrams.

Let us suppose, now, that all the wires of a given aerial line are equipped according to the anti-induction system, also the branching wires, those which are grounded at the terminal stations, and, in fact, all telegraphic wires whose working is susceptible of giving rise to currents in the telephonic circuit by induction or by leakage. Is it possible, under these circumstances, to utilize several single wires on this line for independent and simultaneous telephonic communication? The reply is in the negative: single-wire circuits of the subscribers to the local telephone exchanges. The problem was solved in its greatest simplicity in England at the time when the Post-Office decided to establish, on its poles and for the use of companies having concessions, special circuits, each composed of two wires twisted around each other in helical manner, according to the principle indicated by Prof. Hughes.*

It is well known that the solution consists in introducing an induction coil, one of whose solenoids form spart of the metallic circuit of the *trunk line*, and the other, of that connecting the subscriber, and grounded at each end. In spite of the double inductive transformation introduced in the telephonic system, and in spite of the increase of resistance in the intermediate circuit, long-distance communication remains possible provided the proportion of the resistance of the wires of the "repeating" induction coils is suitably regulated. In the Van Rysselberghe system the question is complicated by the presence of the telegraphic currents and by the necessity of insuring the discharge of the "separating" condensers (Fig. 9.) For this purpose the inventor connects with the ground the middle portion of that of the two wires of the induction coil which constitutes the telephonic "bridge" between the two lines (L_1 L_2, Fig. 10). This wire of the induction coil is represented by the heavy zigzag line; the other wire, which is in the local telephonic circuit itself, is shown by the lighter zigzag line running parallel with the first. We may suppose the course of the telephonic currents to be as shown by the arrows. In reality it is necessary to prevent the mutual reaction between the two portions of the induction coil, and to separate them; each portion, therefore, constitutes a distinct induction coil which has

* Journal of the Society of Telegraph Engineers, Vol VIII., 1879.

nothing in common with the other except the ground connection, and the axes, or iron cores of the two coils, are placed at right angles to each other. This relative disposition of the axes is also followed in the arrangement of several graduating electro-magnets when these accessory devices are to be placed side by side, though M. Van Rysselberghe obtains the desired result by placing each electro-magnet inside a soft iron cylinder. A curious consequence of the arrangement shown in Fig. 10 is that if, in the absence of all telegraphic transmission, one of the wires L, L, or L_2, is "opened," the loudness of reception does not differ appreciably from that obtained over the double circuit.

It is clear that the "translating bobbins," or, more properly, the "repeating bobbins," and the separating condenser should be placed in the terminal telephone stations of the *trunk line*, and not in the central telegraph offices. It is also desirable that each connection between these offices should be made by means of a leading wire looping through the induction coil with a return wire that goes to the ground, and that these conductors should be insulated to at least the same degree as the telegraph wires. Heretofore, relying on the real good will of telephonic currents to reach, in sufficient quantity, the other end of a city wire laid on miserable insulators, the subject of insulation has scarcely been a subject of preoccupation; yet the reciprocal echoes of neighboring conductors may be due quite as much to leakage as to induction. We believe that this consideration should no longer be neglected, if we wish to see the success of long-distance telephony directly between the telephonic subscribers of cities. Perhaps it will be necessary also to increase the power of the telephone transmitters in ordinary use pending the invention of a true telephonic relay. It is already necessary, in the Van Rysselberghe system, to avoid the use of bells operated by battery currents and the ordinary magnet bells, for calling from one central office to another, in order not to disturb the telegraphic operation of wires worked duplex. Therefore, the telephonic apparatus must produce of itself a signal sufficiently loud to awake the attention of the central office called.

We have admitted, so far, that a telegraphic wire only lends itself, in a supplementary manner, to the purposes of telegraphic communication between two given points, when it is continuous from one end to the other. This condition is not absolutely necessary. Let us suppose two wires connecting respectively the stations A and C to a third station B, where they are grounded through telegraphic apparatus; it is sufficient to *shunt* the whole of these apparatus by a bridging wire with a condenser, placed between the line wires in station B, provided that each set of apparatus presents a resistance of at least 500 ohms to the telephonic currents.

In the event of using, between two places, several telephonic circuits, each composed of two telegraph wires running parallel on the same poles, and arranged according to the Van Rysselberghe system, it is very important to decide on the degree of purely telephonic influence which these circuits retain over each other. If the conversation carried on over one of them is re-echoed on the contiguous wires to such an extent as to become intelligible the advantage of the double wire disappears and the means of duplex communication are obliged to be limited to a single conductor with ground connections at each end. The remedy would be in this case also to make the wires cross each other from pole to pole, as is done in England; but this plan would necessitate the entire relaying of the telegraph lines, and it would be impracticable in countries where the insulators are secured to the poles themselves instead of being supported by arms or crossbars.

The experiments so far made in Belgium on lines of 100 kilometers and less have shown that when the planes of each couple of wires are parallel and nearing to each other the voice is heard by induction. However, the induction diminishes and disappears when these planes are separated, or, better still, when they cross each other to the extent of being perpendicular to each other. For example, an excellent result is obtained by coupling the first wire on the right side of the poles with the second on the left side, and the first wire on the left with the third on the right. The inequality of the inductive effects of the adjacent wires on each of the telegraphic conductors composing the telephonic couple is remedied by the repeating induction coil. For this purpose the inner solenoid is moved within the outer one, of the repeating induction-coil corresponding to the telephonic wire more strongly acted upon in such a manner as to diminish the inductive action of the primary and secondary solenoids. In this way the reciprocal induction between double circuits laid on the same supports may be rendered almost inappreciable. Besides, it is of but little consequence, in practice, whether a conversation on an adjacent wire is *heard;* it is sufficient that it be not *understood.*

A direct consequence of the application of the Van Rysselberghe system is the necessity of strengthening the telegraph batteries to make up for the fixed additional resistance of 1900 ohms* produced by the graduating electro-magnets in each circuit. It is not strange that one should be startled at first thought of the expense entailed by this, for the installations must be made in all the offices whose wires may act on the telephonic wires either by induction or by bifurcation of currents. Nevertheless if we calculate the expense that would be required for telephonic lines specially constructed, for a number of circuits equal to that furnished by the telegraph wires existing in a given telegraphic network, we will immediately perceive the economic advantages of the methods of M. Van Rysselberghe.

It is from these considerations, and in view of organizing without delay a telephonic service between the principal parts of Belgium—the first step toward an international service—that M. Olin, minister of public works, has approved, in December last, a contract under which

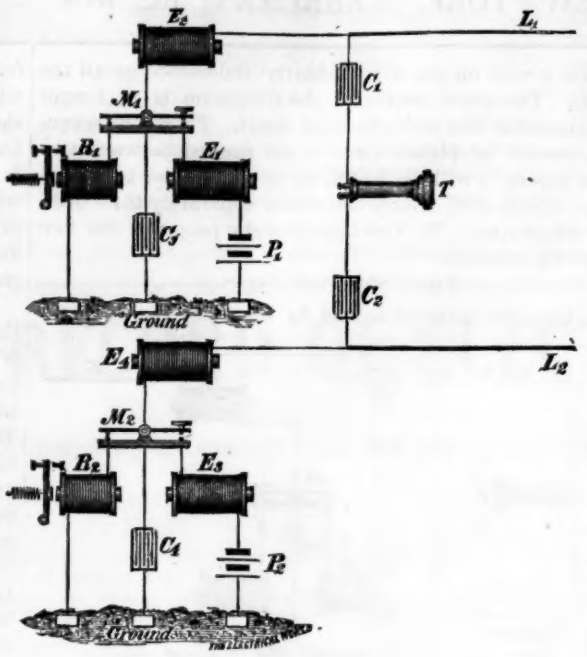

Fig. 9.

the firm of Mourlon & Cie, of Brussels, has engaged to furnish, under the direction of the inventor, all the accessories of the Van Rysselberghe system necessary for equipping the Belgian telegraphs.

In conclusion, we have to meet the objection made by Mr. W. H. Preece, in a paper read at the Southampton meeting of the British Association in 1882: "What advantage is there in communicating verbally on a wire to the detriment of telegraphic communication? In England speed is everything, and we eliminate all the influences which retard speed; consequently electro-magnets and condensers are out of the question. They retard telegraphy."

If the Wheatstone automatic were in use in Belgium we might have tried to determine in *anima vili* the influence of the anti-induction arrangement on the rapidity of working of this apparatus, after having taken care to increase the electro-motive force, so as to let the current retain its original intensity. But we have no doubt that the governments which utilize rapid systems—Great Britain, France, Italy, Russia and Sweden—will consent to try on their

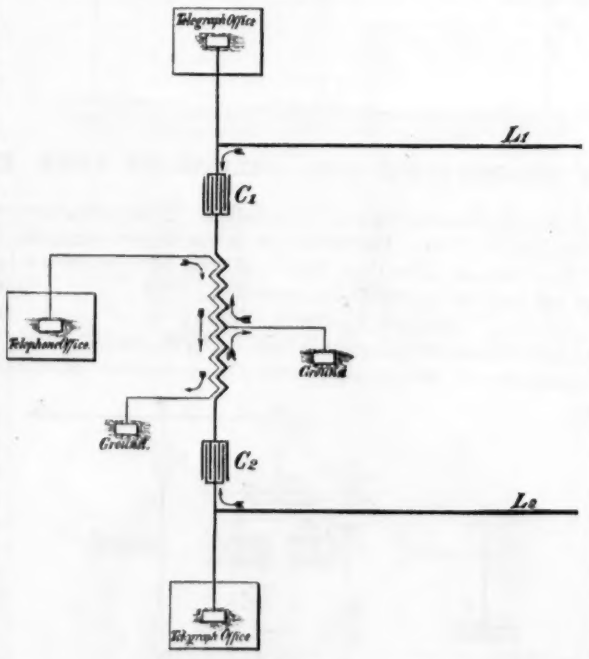

Fig. 10.

lines the experiments destined to elucidate this point practically, and to publish the results. As it is, we have worked on a wire 244 kilometers long with Hughes apparatus adjusted at 150 *turns* of the rider, without producing a wrong letter or any derangement whatever by alternately introducing and cutting out of the circuit an electro-magnet of 1000 ohms, the most complicated classical combinations being transmitted. Besides this, for about two months, the Brussels (North) office has worked with Paris (320 kilometers) at 145 turns, the graduating electro-magnet being then inserted in the shunt of the Hughes magnets. This harmlessness of the anti-induction system evidently applies *a fortiori* to Morse working.

The inventions of M. Van Rysselberghe are patented in all countries.

* Of late the inventor has adopted a new combination which reduces the resistance to 1000 ohms.

A Portable Telephone.

Capt. Lina Beecher, connected with the Military Telegraph Service during the civil war, known as the inventor of the Beecher telephone and as one of the pioneers in the telephone business, has recently invented a portable telephone system that is regarded by electricians and telephonists as a really good thing and one for which there is already a great need in various directions. The system comprises means of communication by telephone between a fixed and a moving point, or between two movable points. Thus, by its use, communication can be held on the sea between a ship and a boat, or a fort and a ship, or between two ships. On the field of war it can be used between the different corps of an army or the officers in command. It may be used by the members of an exploring expedition or by a surveying party. In short, the uses are so numerous that it would occupy too much of our space to specify them all. The apparatus consists of a reel which while providing for uncoiling and recoiling the wire, also completes, by its mechanism, the circuit through the apparatus carried by the operators communicating. The devices for this purpose, for switching, rolling, and the like are very ingenious, and effect the object satisfactorily. The wire used is specially insulated, so as to withstand water should it be submerged or pass across swampy country.

The superiority of the Beecher portable telephone system over the slow and cumbrous field telegraph, and its applicability to uses for which the telegraph is not available, can be seen at once.

In order to develop Capt. Beecher's invention commercially the American Portable Telephone Company has been incorporated in this State with a capital of $2,000,000 in 200,000 shares of $10 each, the incorporators and trustees being Lina Beecher, W. J. Johnston and John B. Sabine. The objects of the company are: "To make, buy, sell, lease, operate and maintain all kinds of portable telephonic apparatus, lines and cables. To obtain licenses, franchises and patents on portable telephonic systems or on any device or appliances for the same in any country, and to sell, lease or assign interests in the same. To license individuals, companies or governments to use such systems as this company may acquire, and to make, operate and deal in portable telephonic apparatus."

At a meeting held on the 14th inst., in this city, Mr. Henry W. Pope was elected President of the company, Capt. Lina Beecher, Vice-President; and C. H. Sewall, Secretary and Treasurer. It is the intention of the company to dispose of its patents to the various North and South American and European governments for military and naval purposes. Outside of that promising field, there is a wide use for the system in surveying, railroad construction, and miscellaneous industries.

Western Notes on Electric Lighting.

The Merchants' Electric Light Company, of Danville, Ill., has adopted the Fort Wayne Jenney electric light.

Mayor Zollinger and the Common Council of Fort Wayne, Ind., visited Logansport, Ind., last Tuesday, for the purpose of investigating the electric light system in that city. They left well pleased and with the determination, it is said, of lighting their entire city by electricity in the near future, using the novel and popular method of tower lighting for the suburbs. Logansport has fifty Fort Wayne Jenney electric lights suspended at the intersections of business streets now.

The Star Iron Tower Company was recently incorporated at Fort Wayne, Ind., succeeding to the business of the late firm of O'Beirne Bros. & Co., Elgin, Ill.

Judge Romans has increased his fifteen Arnoux-Hochhausen light plant at Deadwood, Dak., having ordered thirty Fort Wayne Jenney electric lights. Deadwood is 200 miles from the railroad, and the dynamos have to be transported by teams from Pierre, D. T.

Mayor McNamara and the Common Council of Freeport, Ill., visited Elgin, Ill., last week to see the tower method of lighting. They were entertained by the Elgin city fathers. The city councils of Rockford and Ottawa, Ill., have also recently visited Elgin on a similar trip of inspection.

Studies at Yale.

Mr. William D. Ely, of Providence, R. I., has lately presented the Winchester Observatory at Yale with two instruments to be used in calculating and recording the variations of the magnetic needle. One of these instruments is a magnetic dip circle, used to measure both the vertical dip of the needle and the total force of the earth's magnetism against gravitation. The other is a magnetometer made by Elliot Brothers of London. This instrument, which is the larger and more valuable one of the two, measures either the horizontal force of the earth's magnetism or the direction in which it points on a horizontal plane. Great difficulty is anticipated in properly adjusting these instruments on account of the peculiar magnetic position of the observatory, it being situated midway between East and West Rocks, each of which exerts a strong magnetic influence upon the instruments, which force must be calculated before the variations of the needle can be correctly observed and measured. The donor, Mr. Ely, is a graduate of the class of '36, and for several years after his graduation was Latin tutor at Yale.

Electric Lamps and Regulators.*

BY DR. N. S. KEITH.

(*Continued from page* 43.)

The captivating features of incandescence electric lighting, as compared with arc electric lighting, are the absence of necessity for frequent replacing of the material which emits the light, and the consequent saving of expense for materials and attendance. Experimenters, up to the time we are now considering, had not only to contend with the imperfect and expensive modes of producing electricity, but also with the poor but expensive carbon pencils then made, and as well with the imperfect mechanisms which had been devised.

Therefore, a material which could be heated to incandescence without waste seemed to be just that which was requisite. Among those who thought the substance had been found was Way, of England, who made a mercury lamp. Its principle is illustrated by Fig. 11. *a* is a vessel containing mercury, which is allowed to run in a thin stream through the nozzle *b*, upon the carbon cylinder *c*. which is embedded in the standard *d* of refractory material; *f* is a glass tubular cylinder fitted air-tight between the vessel *a* and the base of the apparatus. When current is caused to enter the mercury in the vessel *a* and pass to *c* by the thin stream, the mercury in the stream is heated to incandescence, is volatilized, and condensed on the walls of the glass *f*, whence it runs to the bottom and flows out of the tube *e* to a suitable receptacle. From this last the mercury may be continuously raised to the vessel *a* for use again. There are several reasons why this arrangement was not, and cannot be, successful. One is the almost inevitable escape of mercury-vapor. The inventor himself met his death from mercurial poisoning, due to inhaling some of the vapor from his apparatus. But the radical fault is that incandescent mercury gives but little light—a very small percentage of that which can be obtained by the same amount of electrical energy applied to other substances—carbon, for instance. But this idea had its votaries and varieties. Patents were taken for the use of melted lead or other metals in place of quicksilver.

The famous Serrin lamp was invented in 1857. It marks the close of the electric lighting period which we have been considering; and has survived the period of inactivity which followed and lasted until 1878 or 1879, and its principal features are embodied in many of the lamps in prac-

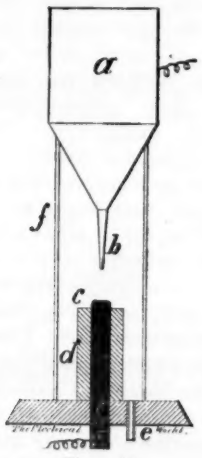

FIG. 11.

tical use to-day. It is illustrated in principle by Fig. 12, in which the guides, frame-work, casing, etc., are left out as not being of importance within the scope of our description.

Upon the base *O* is the standard *P*, to which is pivoted the quadrangular-frame *E E*, which has at its lower right-hand corner the armature, *D*, of the electro-magnet *L*. The carbon-carrying rod *A*, has a rack which engages with the teeth of the uppermost wheel of the train which ends with the fan-wheel *e*. The arms of this fan-wheel engage with the detent *g* when it is depressed. The uppermost wheel has a drum *h*, of half its diameter on its shaft. Upon this drum are a few turns of the cord *d*, which runs over the pulley *C*, and connects with the negative carbon carrying-rod *B*, by its arm at *x*. The quadrangle and its attachments are held up by a spiral spring not shown. When no current is flowing in the lamp the carbons are in contact. When circuit is made the electro-magnet moves the armature downward and in so doing lowers the negative carbon and brings the detent into engagement with the fan-wheel, so that the train of wheels cannot rotate, to prevent the downward movement of the positive carbon. But when the current has decreased, by reason of combustion at the arc, *D E* and *g* move upward so that the fan-wheel may move, and the carbons move toward each other in evident manner. It will be observed that owing to the cog-wheel which engages with the positive carrying-rod being twice the diameter of the drum *h* on which the cord is wound, the positive carbon moves downward twice as fast as the negative carbon moves upward during the feed movements. This so compensates for the difference in the rate of combustion of the two carbons that the light remains approximately in the same place.

We will now enter upon the consideration of two of the earliest types, or rather premonitors, of the so-called "differential" lamps of the present day; which lamps have made a practical art of electric lighting, as much as has any part of the "systems" of which we hear so much.

Fig. 13 represents the principle of the lamp patented by Lacassagne and Thiers in England in 1856. On the base *A* are the two electro-magnets *B* and *C*, and also the cylinder *D*, within which is a plunger *E*, which carries the lower carbon. The inside of the cylinder is connected through

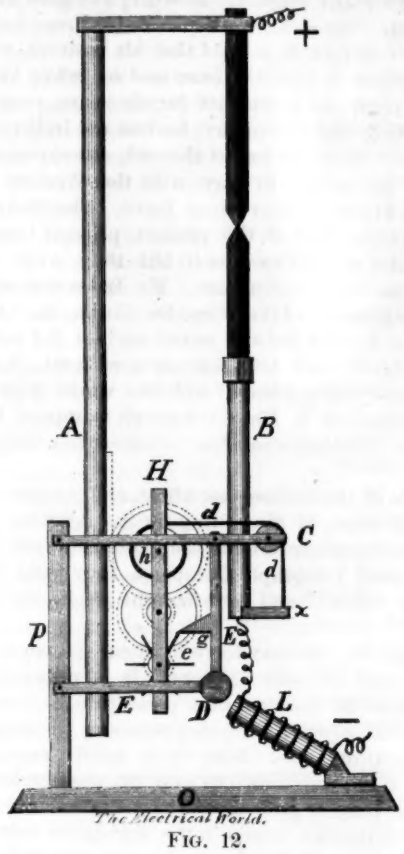

FIG. 12.

the pipe *L* and rubber-hose *G*, with the vessel *F*. The iron oscillating-lever *H*, is pivoted near its centre, and carries at one end the connecting-rod *I*, which operates the valve *K*. The current enters at the upper-carbon and in the main traverses that, the lower-carbon, the cylinder *D*, the electro-magnet *B* and out at the sign —. The wire of magnet *B* is large and short. The wire of the magnet *C* is fine and long, or, in other words, is of high resistance. The current which flows in the coils of *C* is branched from the main-circuit where it enters the upper-carbon, and consequently does not enter the arc at all. It joins the main circuit again at near the — sign as shown. This current, which does not enter the arc, and takes no part in the light, is used solely to effect the feed movement of the lower-carbon, as the upper-carbon is fixed. The percentage thus lost to the light can be made very small—say ½ of 1 per centum, or even less—as the amount of current thus diverted bears the proportion to the whole which the resistance of the

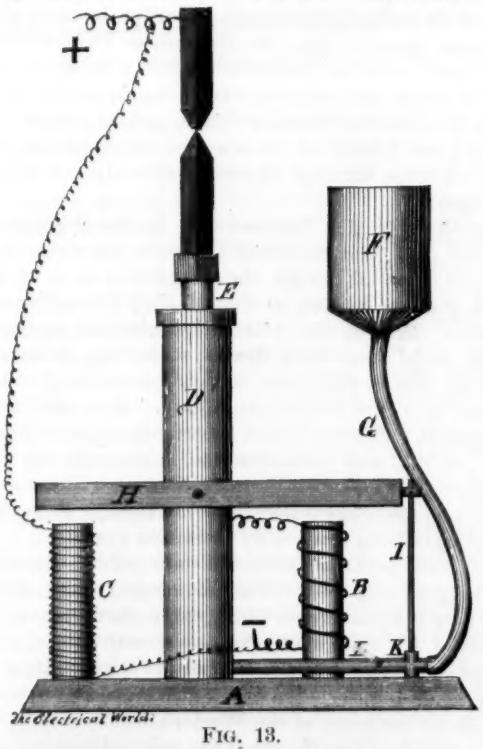

FIG. 13.

main circuit from + to — has to the fine wire circuit from + to —. If the former resistance be 5 ohms, and the latter 500 ohms, the loss to the arc is 1 per centum.

Mercury is used to fill the vessel *F*, the hose *G* the tube *L*, and the space in *D* not filled by the plunger *E*. Before current is started the valve *K* is open and the mercury forces the plunger upward till the lower-carbon impinges on the upper-carbon. When current is started the arc must be manually formed by moving the upper-carbon away from the lower. As the arc becomes longer more and more current flows through the fine wire circuit, until, finally, the current is so increased that the magnet *C*, becomes strong enough to move the end of the lever *H* downward by attraction, and raising the other end with the rod *I*, and opening the valve *K*, so that mercury flows into the cylinder *D*, and raises the plunger *E* and lower-carbon to shorten the arc. As the arc becomes shorter less current flows through the fine wire and *C* becomes less magnetic, so that the lever *H* rises and closes the valve which stops the flow of mercury, and therefore the feed of the carbons. This operation is repeated from time to time as the carbons burn away. Now all this is in obedience to the law which says "that electric current is divided between two closed circuits in *inverse* proportion to the respective resistances." As the resistance of the main circuit through the arc is continually changing, and that through the fine-wire is approximately unchanging, it follows that with each increase in resistance in the main circuit there must be a corresponding increase in the current flowing through the fine-wire circuit; and with each decrease in the main a corresponding decrease in the fine. The only service which the main-magnet performs is that due to *decrease* of current. When this decrease takes place in the same manner and for the same reasons, as we have repeatedly explained, it may be said to help the magnet *C*, because it pulls less hard on the lever *H* against the attraction of the magnet *C*.

This is not an essential service, and in present systems would not be of the slightest use, because the current in the main line is kept at an approximately constant value. It is like some of the earlier single-magnet lamps in the particular of not automatically forming its arc.

One of the early so-called "differential lamps" is that of Tchikoleff, of St. Petersburg. This is also a motor-lamp. It is illustrated by Fig. 14. On the base *D* are the two electro-magnet-limbs *E E*[1], with the pole-pieces *a* and *b*, which have a shape like the pole-pieces of a Gramme dynamo—*i. e.*, they almost encircle, concentrically, the armature *K*, which is made, also, like the armature of the same machine. The brushes on the collector are at *m* and *n*. A superstructure carries the standard *G* and

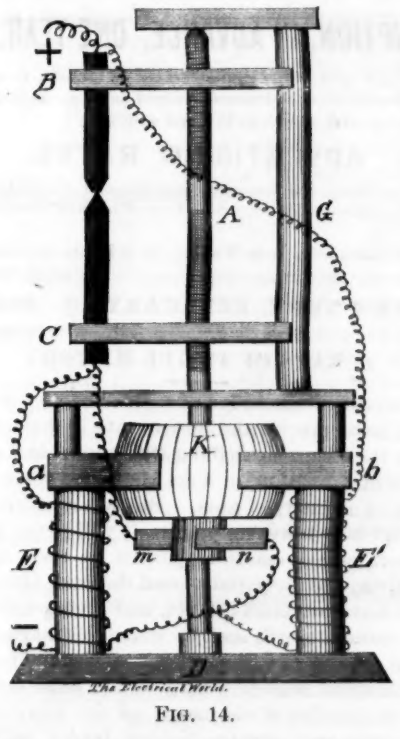

FIG. 14.

the vertically movable arms *B* and *C*. These arms carry the two carbons and are movable to and fro by the right-and-left screw *A*, which is an extension of the shaft of the armature *K*. When the armature is turned in one direction the arms *B* and *C* are moved by the screw away from each other; and when it is turned in the other direction they are caused to approach in obvious manner. The circuit connections are as shown. The main current flows from + through upper-carbon, to under-carbon; there divides and flows in parallel circuit through the brush *m*, armature *K*, brush *n*, to — for one circuit, and through the coils of magnet *E* for the other circuit. At + *B* a portion of the current is diverted to flow through the high-resistance-circuit-magnet *E'* to join the main circuit at near the magnet *E*. The two magnet-cores are wound in the same direction and their respective currents also flow in like direction, so as to make the two poles *a* and *b* alike. The current which flows through *K* has the direction which causes the side toward the observer to move toward the stronger north-pole. The currents passing through the magnet coils in the same direction tend to make the poles both of north-polarity. When circuit is made the magnet *E* receives nearly all of the current, and therefore its pole is the stronger and the armature moves toward it, and in so doing moves the screw *A* to separate the arms *B* and *C*, and the carbons to form the arc. As the arc increases in length the magnet *E'* increases in strength until it becomes stronger than *E*, and in consequence thereof moves *K* toward it, and also the screw *A* in the direction to screw *B* and *C* and their attached carbons toward each other until that equilibrium of magnetism is attained under which *K* is equally attracted by both magnets and consequently does not move. Movement, however, again takes place as soon as the arc has become long enough to make the necessary variance of resistance.

(*To be continued.*)

* Lecture delivered before the New York Electrical Society, Jan. 16, 1884.

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SCRAPS OF INSIDE HISTORY.

It is sometimes demanded of historians now-a-days that they shall be as precise and as accurate in their statements as though they were describing the process and result of a certain chemical action, or were detailing observations on the habits of a colony of ants. But while severe accuracy of this kind may have its merits, it will never satisfy the public, nor, indeed, can it do justice to men and events. He will always be the popular, and the best, historian who, careful to have his dates correct, and giving full weight to official documents, will seek to make his narrative somewhat less cold and rigid than the postulates and verifications of mathematical science. He will add local coloring; he will seek in bundles of old letters for the secret motives of men; he will not despise fashion books, ballad broadsheets, the current slang, or political caricatures. Everything that can give life and animation to the picture will be seized and prized, and then his readers will not see men of old as trees walking, but as beings of like passions and foibles and heroic virtues with themselves. What people want is not a dry list of names, dates, and events, with explanatory notes, like a museum catalogue, but history "done to the quick," throbbing in every page with the emotions of bygone days, instinct with poetry and life.

We think that telegraphic history should, within due limitations, answer to this theory, and in our columns we have always endeavored to "show virtue her own feature, scorn her own image, and the very age and body of the time his form and pressure," in so far as relates to the world of electricity. Just now, our columns are full of the record of the changes going on in the personnel of the leading telegraphic companies, and off the gigantic strides that some of these companies are making. Most of the information we gather is found, so to speak, on the surface, but there is not a little gossip as to the reasons for certain actions and the way in which the telegraph wires are pulled. We should not be doing our duty to neglect this gossip, though some of it may have as little foundation as the stories hatched by the members of Sheridan's "School for Scandal." Some of it appears to be a shrewd guess at the truth, and we give it for what it is worth.

One of the events that has most exercised, not only the mind of the telegraphic fraternity, but that of the public at large, is the transfer by Mr. D. H. Bates of his services from the Western Union Company to the Baltimore & Ohio Company. There are many persons yet who put their tongue in their cheek and contract the muscles of their left eyelids when it is affirmed that Mr. Bates has bidden General Eckert an adieu that was the last and was not fond. But is a rupture of the old connection so very improbable? At the time that Mr. Bates went back to the Western Union Company from the American Union his salary, then $9,000, it is said, was cut down to $7,000. That reduction did not accord, so the story goes, with Mr. Bates' idea of the fitness of things, and he never relished it. He admitted the necessity for the most rigid economy, and in a general way thought reductions in salaries more or less necessary, but he could not see why his little stipend should be interfered with. Perhaps few readers of THE ELECTRICAL WORLD would like to have their salaries cut down $2,000 a year, though many might try to worry along on $7,000 a year. But Mr. Bates had other crumpled rose-leaves in his existence—in fact, it is said that his position was not of late altogether a pleasant one; and so, when the offer of $15,000 a year, on a contract for six years, came from the Baltimore & Ohio Company, he was not indisposed to make a move. Still, the ties of the old attachment were strong, and he offered to stay with the Western Union Company at $12,000 rather than leave. The Board met, and they thought that at the present price of bread and meat Mr. Bates wanted too much; but they were willing to compromise on a smaller sum. Mr. Bates was not in a compromising mood. Like Cap. De Costa, in "Oakum Pickings," he wrote a laconic note, saying: "I works no more; I resigns," and left the office without, it is said, bidding good-by to anybody, and the world soon knew that the Baltimore & Ohio Telegraph Company had exchanged its dilettanteism for a vigorously aggressive policy.

That is one of the stories now afloat, and we have reason to know that there is something in it. Another story is that since the Baltimore & Ohio Company acquired the lines of the National Telegraph Company, they sold Western Union stock "short," and were caught in its unexpected advance.

A little later on, we may have it in our power to give a few more scraps of inside history. It is noticeable that the legislators of this country constitute a "one-idea" body, and that when the one idea possesses them they can attend to nothing else. Now it is tariff; next session, free ships; then, railroads; by and by, postal telegraphs; most of the time, a grab at the treasury balances. This year the investigation mania in the legislative mind is directed toward the telegraphs of the country, and there is already a welter of evidence on the subject. We learn that the latest of the resolutions passed affecting telegraphic interests directs the Senate Committee on Post Offices and Post Roads to ascertain whether any of the Baltimore & Ohio people have made or received any proposals, or entered into an agreement to consolidate with the Western Union Telegraph Company, within the past twelve months. Perhaps the Committee will bring some savory clams out of the sand in which it has been so sedulously digging.

CONGRESSIONAL INVESTIGATIONS.

Of making Congressional investigations there is no end, and one of the latest, that of the Senate Committee on Post Offices and Post Roads in regard to the subject of postal telegraphs, has already become as wearisome as some of its useless predecessors covering the same ground. Up to the present time the Committee has learned very little that is new and has been deluged with much that is old. Its report will make serious demands on the resources of the Government Printing Office, and as serious on the patience and leisure of the average Congressman, who is expected to go through it conscientiously and then vote intelligently.

Elsewhere in this issue we sum up the evidence as far as it has gone, and even with the most favorable showing it would seem as though the proportion in it of fact to talk is about as uneven as that of Jack Falstaff's bread to his wine. Most of the information obtained by the Committee could have been drawn with very little trouble from the files of this paper, which are at the Committee's service at a low subscription rate. It is said that the Committee will soon report favorably a postal telegraph bill. As that was understood to be its intention when it began, such a result of the investigation will not occasion much surprise; but it does seem as though the same end might have been reached by a cheaper process.

One little point has attracted some public attention. It is in keeping with the incidents mentioned by Mr. Hubbard, and there is much more of the same character that could be added, if that is what the public want the Committee to find out. The evidence we refer to is given thus: "Answering an inquiry from Senator Wilson, Mr. Bates said that in the majority of the Western Union contracts there was a clause to the effect that the railroad companies along whose lines telegraph lines were constructed should not transport material for other telegraph companies. Explaining this, he said, while the contracts did not provide that there should be no transportation of material for any other telegraph company, the contract did provide that the railroad company should only haul the rival telegraph company's poles, etc., between stations at the regular local tariff prevailing for like material, which practically amounted to a prohibition, as the poles must be distributed, of course, along the entire route."

There is a demand for the names of the companies spoken of by Mr. Bates, and it might be interesting to know them. But one would hardly expect to find the Baltimore & Ohio Company helping another telegraph company in a special way to put up poles and wires along its tracks, nor would one expect the *Century* to give a new monthly magazine the use of its subscribers' names so that the latter could drum up support in starting. Altruism is a very good thing, but, unfortunately, it has not gone that far yet.

There are meaner things in the history of the Western Union Company than the employment of these railroad contracts to keep dangerous rivals out of the field. But they do not go to prove that postal telegraphy is, therefore, the one thing needful to the perfection to telegraphic intercourse. If they do, it would be carrying the argument only one step further to say that the corruptions of the "rings" and "bosses" in the great cities of our land, and the intrigues of politicians and lobbyists in Congress and in the State legislatures, prove Americans to be incapable of managing their own affairs and in need of a strong autocratic rule, based on the pure and high-minded principles of Germany and Russia, where the government already works the telegraph system.

AN ERA OF COMPETITION.

The first impression to be gathered from a glance around the domain of the practical applications of electricity is that a great deal of competition is going on or is at hand. The electric light companies have proclaimed a divorce between "sweetness and light," and have entered upon a rivalry that is very warm and most interesting to watch. In the telephone business we are threatened, somewhat theatrically, with lively times not in the far, far distance. The telegraph companies have girded up their loins and have their muscles tensely strung for the race, and now the cable companies multiply so quickly that in a short time their competition will evoke from the denizens of the deep more complaints about "buried" wires than are heard from citizens in New York about overhead wires.

We give in this issue a large map of the track of the new Bennett-Mackay cables between Ireland and Nova Scotia, showing the shore connections on this side with Boston and New York. The heavy lines indicate the position of the cables and the points at which they branch off to their respective termini. According to latest accounts, the Commercial Cable Company is making rapid progress, spurred on, no doubt, by the feeling that the public takes a deep and friendly interest in the development and success of its plans. We learn that the company has already made arrangements to do European business. The editor of London *Truth* invited Mr. Mackay recently to take a hand in Eastern telegraphy as soon as he and his friends had "smashed up" the Western monopolists, and said: "I have more than once pointed out that when a company issues a few millions of paper capital, buys up for nearly a million 'rights' which are no rights, and starves out competitors until they are obliged to sell their cables to it, its fate is sealed whenever it comes across a man who is neither to be bought nor cajoled, and who is rich enough to fight." Whatever may be the encouragement Mr. Mackay and his friends derive from this, they have already secured a foothold on the European mainland. From the Submarine Telegraph Company, which holds a monopoly of the right of laying cables in the English Channel, the Commercial Cable Company has obtained permission to lay its cables there, and the Submarine Company undertakes in case of interruption or accident to convey all the messages of the latter directly through its own lines across the channel until the completion of the repairs. The Commercial Cables will run directly into Havre, thus being carried near to Paris.

Modern civilization finds one of its broadest and strongest bases in the rapid interchange of intelligence, and for that reason alone, if for no other, we welcome the laying of new cables that lessen distance, facilitate intercourse, and destroy the erroneous idea that cabling is necessarily a luxury. In these days cabling is an absolute necessity, and the men who bring it within the reach of all are public benefactors. If, in doing good, they help themselves, so much the better. Nobody grudges honest profits on a cheap service efficiently conducted, and that we are entitled to expect from the Commercial Cable Company.

We said at the outset that this is an era of competition. But there need not be animosities in consequence of the struggle. There is room for all, especially in the cable business, the opportunities of which have never had a satisfactory trial, and were never before so great.

THE WESTERN FLOODS.

Once more the low-lying districts of Indiana, Ohio, Pennsylvania, Kentucky, Illinois and other States are devastated by the floods that herald Spring. The stories of suffering are sad to a degree, and it is pleasant to see that the appeals for help from the inhabitants of the submerged central region are meeting with a prompt and hearty response.

From Cincinnati it is reported that the Ohio has reached the unprecedented height of 71 feet and three-fourths of an inch. As a consequence of the floods there, as well as elsewhere, the telegraph service has been greatly deranged, and communication has been interrupted. Owing to the stoppage of the gas supply by the water, Cincinnati has again had to depend largely on electricity for its light, although we hear that the operators' room in the Western Union office has been illuminated with candles. The

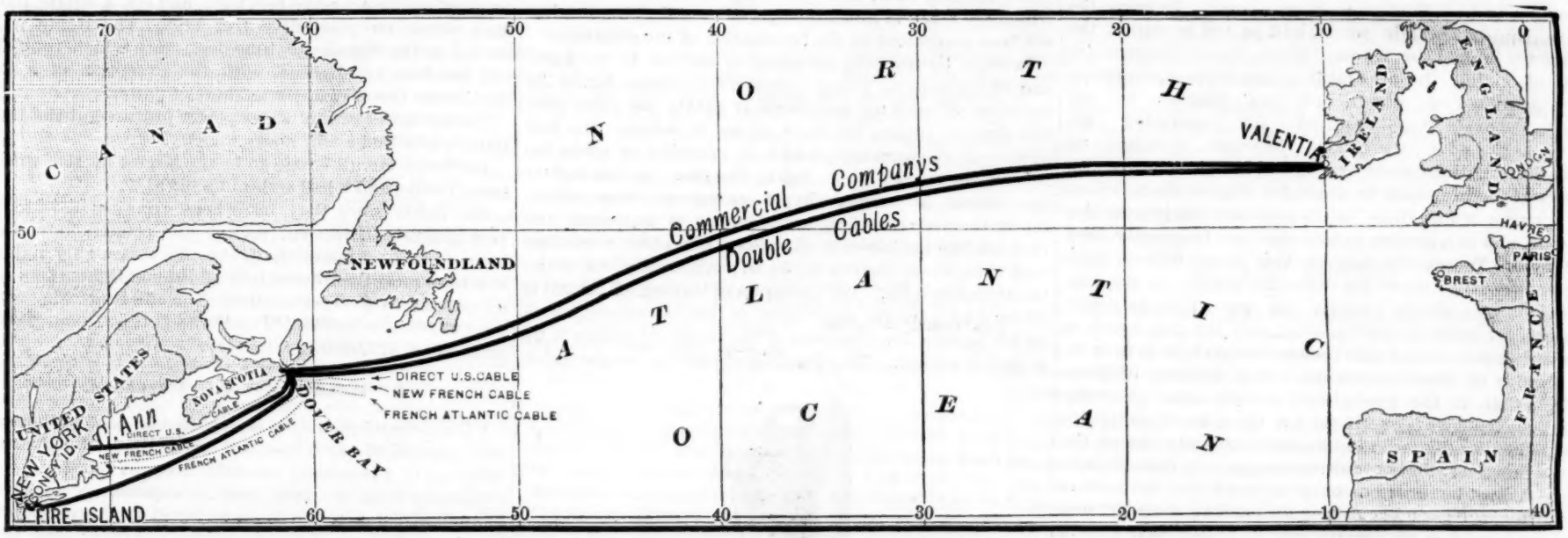
telephone exchange has been overworked, and the local papers say that it is to be doubted whether any persons have had more to do than the operators there. It is estimated that the calls have been about four times as many as usual, while the repair-men have all they can do to keep the lines and instruments in order. The expectation is that Cincinnati will be another week without gas, but it will not be deprived of its electric light.

IS THERE TO BE A TELEGRAPHIC WAR?

Careful observers of the recent course of affairs in the telegraphic world say that the public may expect to see shortly, not a consolidation of two or more of the four companies now preparing for active work, but a very keen competition. At any rate, Mr. Garrett has thrown down his gauntlet at the feet of the Western Union Company, and if solemn promises, pledges, denials, asseverations and vows mean anything at all, they mean that there will be a severe struggle for business between the two. But the Bankers and Merchants' Company and the Postal Telegraph Company are both ready for the fray, too. It is not improbable that there will be a war of rates, after the usual railroad fashion, and that then, exhausted and impoverished, the companies will agree on a binding schedule or will try to consolidate. Perhaps the consolidation will happen first, but, whether first or last, there is hope of genuine competition for some time to come. Mr. Garrett, by the way, has expressed his belief that the day of consolidations has gone by. He may mean by that remark that the country is a little too big now for one company to look after.

The Bennett-Mackay Cables.

We are enabled, through the courtesy of the New York *Herald*, to present in this issue a fine map of the track of the new Atlantic cables to be laid down by the Commercial Cable Company, of which Messrs. James Gordon Bennett and John W. Mackay are the leading spirits. It shows the position of the two cables and their American shore connections with Boston and New York.



THE TRACK OF THE BENNETT-MACKAY CABLES.

One cable, landing at Cape Ann, will be able to carry messages direct to Boston and the Eastern States. The other will run up to Fire Island, and thence through the Great South Bay to Coney Island and right into New York by means of underground cable. This route has been carefully chosen with a view of avoiding the danger of possible damage from ships' anchors.

Both cables will run down the coast from Nova Scotia in a depth of water not less than 100 fathoms. From the same consideration Fire Island was selected as the point of destination in preference to Sandy Hook. Mr. Mackay, who has determined that the new cable enterprise shall be a success, has looked after every detail and has procured every means which a liberal expenditure can command and the skill of the most experienced electricians can suggest for providing against all eventualities.

A steel repairing steamer of 1,500 tons and 1,400 horse power, capable of carrying 750 tons of cable besides its coal, and steaming eleven knots, has been ordered from Messrs. Elder, who will build it under the supervision of St. Clare Byrne, for many years manager of Laird's shipbuilding firm.

Investigating the Telegraphs.

Column after column of the daily papers has been filled during the last week or two by the evidence given before the U. S. Senate Committee on Post-offices and Post Roads, regarding the proposed postal telegraph measures now pending before Congress, and the various telegraph interests of the country. The Committee has had before it a number of notabilities, including Dr. Norvin Green, Wm. M. Evarts, Gardiner C. Hubbard, Robert Garrett, D. H. Bates, the officers of the Postal Telegraph and Cable Company, and others concerned. The ground covered by the investigation is already of generous extent, and includes telegraphy in its postal, political, financial, legal, historical, economic, and social aspects. Whenever the Committee reports, the volume of printed evidence will be a fund of curious and interesting information, but it will not be very short.

We have published Dr. Green's speech, and that will give an idea of the general run of the evidence submitted against government control or monopoly. Mr. Hubbard who went over the hackneyed story of Western Union growth and stock watering, stated that he had been agitating for postal telegraphs since 1868, and he contended that in spite of the fact that several companies are now in the field the telegraph business would always be a monopoly. He summed up some of the evils of the present system as follows:

A few years ago a man started a news bureau in Cincinnati. A correspondent in New York filed the market reports each morning and the Cincinnati gentleman sold the information to customers. The Western Union asked him to sell out to them and he refused; thereupon his messages were taken away from the "through" wire and sent by a "way" wire. The difference in time was an hour, and the man was ruined. What were the relations of the Western Union to the people of the country in their social and political interests? The Western Union was controlled by three or four gentlemen in New York. It controlled the market prices, all the political and general news sent over its wires—every single important personal communication sent in the country. This company was controlled by no law except the interests of its owners. No State could pass a law which should have any effect on this corporation. Was there any other like power in the world? It would handle 160,000,000 of messages ten years hence. Through its agency it collected the market news in London and Paris. A fraction of a penny a pound on cotton was a fortune to any man. They admitted no partnerships in this business. He made no charges, but he believed this was too large a power to intrust to any man or any company. How is it with the press? The Western Union Telegraph Company and the Associated Press made a close corporation. He did not mean to say there was any fault to be found with the present management. Some time ago two papers in San Francisco discussed the postal telegraph. The rates to those papers were increased. One paper died in consequence and the other ceased to discuss the matter. A paper which once criticised Mr. Orton's course found its rates doubled next day. This was the power which this corporation held.

Mr. Hubbard's argument for the substitution of a government monopoly in place of that which has virtually existed for several years was that the business had always been and would always be a monopoly, and that it was not for the interests of the companies or of the public that there should be competition. This strikes us as weak, and if it is the best argument to be adduced, Mr. Hubbard may have to spend another fifteen years in missionary work.

We have before given particulars as to the new programme of the Baltimore & Ohio Company, and need not, therefore, repeat here the evidence given by Mr. Garrett and Mr. Bates on that subject. Mr. Garrett avowed his belief that the day of consolidations was past, and when asked whether it was not likely that on being offered a big bribe to sell out, his company would transfer its lines to the Western Union Company, Mr. Garrett replied that the company was willing to give any guarantee against it that could be devised. He also made an offer to contract for doing the postal telegraph business if Congress made up its mind to launch the government of the country in a new undertaking of that kind. "If you do not desire," he said, "to throw open the business for competition and award it to the lowest bidder, let the government name its commission to make the rates, and we will accept the rates." Being asked if the offer would cover the whole country, at a regular tariff, Mr. Garrett said he thought that his company would consent to it if the privilege was accorded of opening offices in all the post-offices. As to direct competition with the Western Union Company Mr. Garrett said he might surprise the committee by telling them that the Baltimore & Ohio Company had already leased between New York and Chicago enough wires at a sufficient rental to pay the interest on the entire amount it was proposed to expend, so that at any rate it could live. The company had leased six wires between New York and Chicago at an average rental of $19,000, making $114,000 per annum, or 4 per cent. on $3,000,000.

One of the latest statements submitted to the Committee is that of the Postal Company, about whose service we have also given the fullest information. The Company states that when it has completed all its lines it will be enabled to transact the entire business of the country at the uniform rate of 25 cents per message of 20 words, and at a correspondingly reduced rate for government and press work. It is in contemplation by the Baltimore & Ohio Company to reduce its rates to 25 cents for 10 words east of the Mississippi, with 1 cent for each additional word. Its night rates are now one-half its day rates, while the night rates of the Western Union are two-thirds or three-quarters the day rates.

Underground Wires.

We understand that the Western Union Company intends to take the important step of carrying its lines in cables from the end of the pneumatic tubes in Twenty-third street, along the lines of the Third and Sixth avenue elevated railroads, to the Harlem terminus, and then over the bridge, where the wires will split up and diverge in the usual way. This action will have the effect of removing a great many wires from overhead in New York city. In Chicago, Mr. Barrett, the City Electrician, after examining underground systems East, has contracted for 40 miles of wire to be used as a basis for the new fire alarm system, the wires of which will all be put under the ground, all the poles being removed from the business portion of the city. In Washington, the District Commissioners have again been stirring in the matter of underground wires. They have recently written to the Presidents of the Western Union and Baltimore & Ohio telegraph companies, calling their attention to the fact that within the last four months the United States and District governments and the Postal Telegraph Company had all laid certain wires under ground, and that the telephone and Bankers' and Merchants' telegraph companies were under agreement to lay underground wires on certain routes within a short period. The two first-named companies were requested to consider the subject of laying their main trunk lines under ground, and were requested to lay their wires in the same trunk with the Bankers' and Merchants' line on Fourteenth street, between Pennsylvania and Ohio avenues. The Western Union Company made no answer: but Mr. D. H. Bates, of the Baltimore & Ohio Company, called, it is said, on the Commissioners to express the willingness of his company to lay their lines under ground on Fourteenth street, as requested, and arrangements were completed for beginning the work next week. The system to be used on the street will be a wrought-iron pipe containing the cable of insulated copper wires, the same as has been in use for some years in London.

LEASE OF TELEGRAPH LINES.—The Bankers' and Merchants' Telegraph Company perfected on the 11th a lease of all the Chicago Board of Trade Telegraph Company's lines. The stockholders of the latter company met and signed a lease for 99 years from Feb. 1. The lease guarantees the payment of 8 per cent. on the Board of Trade Company's stock and payment of bonds with interest.

Improved Electric Gas-Lighting Devices.

Electricity has already been recognized as an important factor of domestic luxury, by the many ways in which it provides for safety, convenience, ease, and comfort indoors. In some of these domestic applications it has long since learned to play its rôle to perfection under the guidance of inventors anxious to apply improvements in the devices with which it operates. There are other applications, however, in which it has had less experience, and where inventors have not been quite so successful in promoting perfection. Electric gas-lighting devices constitute one of the most interesting and one of the most useful of these applications which are susceptible of further improvement.

The requirements of an electric gas-lighting device are simple enough, there being only three functions to be performed, namely, to turn the gas on, to ignite it, and subsequently to turn it off. To be able to turn the gas on from a distance by completing an electric circuit—by the mere touch of a push-button—and to be able to turn it off again as easily, affords that convenience which is oftentimes the paramount consideration. To be able to light the gas without a protracted search after lucifers—by means of the electric spark—also affords convenience, and besides it affords safety from fire. There have been many devices produced which were intended to perform these three functions by electrical agency. In such devices the valve which checks the gas is operated by the armature of a magnet. The motion of the armature makes and breaks the circuit just as in an annunciator bell, thus causing sparks at the break in the circuit, which takes place between two points placed near the tip of the jet, so as to ignite the gas as it issues from the jet. The operation of turning off the gas is performed by the same or by another similar magnet. These automatic lighters, as they are called, do not seem to have proved very satisfactory in practical use, however. They do not seem to be always reliable in their operation, either from inadequate construction or from liability to derangement. To move the valve requires a certain power, and as the power of the magnet is limited by its size, which cannot be great for fear of giving the apparatus a cumbrous appearance, the margin of power of the magnet is not much above that required for operating the valve. If now the valve becomes gummed up in its seat, it sticks more or less, and it resists the moving power of the armature to a greater degree than before. As a matter of fact these valves are very subject to this trouble, and to a greater extent the less frequently they are used. To provide against this some makers have "complacently" made the valve fit loosely in its seat. This is a very simple remedy, but one which is dearly bought, for it tells on each gas bill, and the gas which is allowed thus to escape into the apartments tells in turn on the health of their occupants. It is because of these defects that, in the gas-lighting devices most generally used, convenience is sacrificed for the sake of simplicity and reliability, by assigning to electricity only one of the three functions, that of igniting the gas. In these lighters the gas must be turned on or off by hand, and the motion of turning the gas on is utilized for opening a circuit and causing a spark in the issuing gas. It is seen that such a device, while dispensing with the use of matches, does not save the trouble of going to the gas jet to light the gas or put it out, which is what is especially desired in the majority of cases.

We have examined and tested an improved form of automatic lighter recently brought out by the Boston Electric Company, who make a specialty of gas-lighting devices generally. This lighter, which is shown complete in Fig. 1, and with its covering shell removed so as to expose the mechanism in Fig. 2, is free from the disadvantages that we have always found to exist in other forms we have seen and used. To begin with, the valve is tight, and air cannot be sucked through it when closed. It is somewhat conical and held in its seat, which is also conical, by a small spring that keeps it constantly to a bearing, thus insuring tightness, in spite of all wear. Another important advantage is in making the opening small in the valve so that a very slight motion will open or close it. In this case the opening is in the form of a slit or fissure through the valve, which corresponds, in the open position, with the slitted opening in the stem of the jet itself. The most important and valuable feature of this device, however, is that it provides effectually against sticking or imperfect opening and closing of the valve. This is accomplished by allowing the armatures to acquire a certain momentum before they begin to move the valve. The armatures in fact communicate motion to the valve by sudden, hammer-like blows which are just what is needed to start a sticking valve. The head of the valve, seen endwise as a small circle in Fig. 2, is provided with two small arms projecting on either side and bending forward. It is against these extensions that the stems projecting from the armatures strike.

Each armature is pivoted between two small supports, as will be readily understood from the figure, and normally the inner side of each one falls down by its own weight as shown on the left side, the armature on the right side being shown in the act of striking the right arm of the valve, thus moving the valve to the left. This is the motion that would turn off the gas. The left-hand magnet is that by which the gas is turned on. Each magnet is in a separate branch of a divided circuit, and therefore controlled by a special push-button. When the circuit through the left magnet is closed the armature is pulled upward forcibly until its prolongation strikes the left arm of the valve. At the same time that this happens the armature itself strikes up against the lower end of the vertical conductor passing through the case of the

FIG. 1.

lighter, causing it to be lifted bodily. This breaks the circuit at its upper end, which rested downward against a platinum contact, supported by the jet itself. The circuit being opened, the magnet releases the armature, which immediately falls down again, thus allowing the circuit to be closed again, whereupon another upward motion of the armature results, with the effect of giving the valve another hammer blow, and of causing another spark, both of which are ready to finish the operation of lighting if it has not been completed by the first motion of the armature.

In other lighters the armature is secured to the valve and moves with it. This is a great disadvantage, for, as the armature vibrates up and down, it makes the valve open and shut, or, in case the valve sticks, it prevents the free motion of the armature, which is intended to cause the successive sparks that light the gas. In this lighter the valve is struck by a series of taps which repeat themselves as long as the button is depressed, and thus act like the blows of a hammer, the valve remaining each time where the last stroke left it, instead of following the armature back. The operation of turning off the gas is effected by a single movement of the armature which strikes against the right arm of the valve and pushes it up as just described. The operation of turning the gas off is

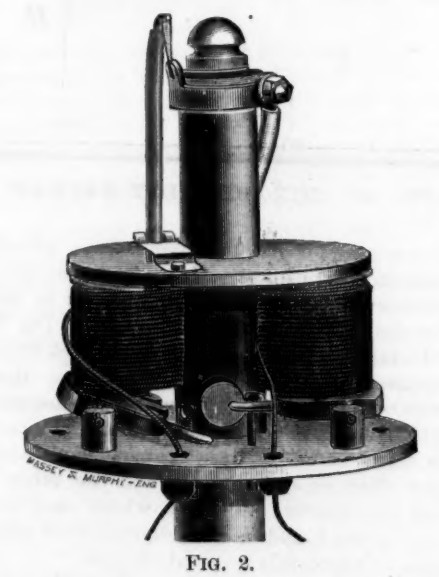


FIG. 2.

always easy, as it occurs when the valve has been warmed and is not liable to stick.

The mechanism of this lighter is, as we see, very simple, and besides affording the advantages just stated, it presents that of not being liable to get out of order, a quality which is assured by the careful and neat workmanship bestowed upon it.

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Underground Wires in Montreal.

A dispatch from Montreal, Canada, of the 14th, says: This city is making an earnest and practical experiment with underground wires, and those who are interested say that they are confident the method will be adopted by the city this spring. A New York man, A. T. Woodward, introduced the invention now in operation, and sufficient capital was supplied by such men as the Hon. J. J. Curran, member for Montreal Centre, and Richard McKeown, the leading contractor of the city. The company has been formed, and will get its charter in a few days. The Common Council gave the investors the right to lay the wires, and in last November ten were buried along Craig street from the Central Fire Headquarters to the City Hall, a distance of nearly three-quarters of a mile. Two of these wires are for the city's use. They supply the electric call bells and work the fire gongs. The other eight are used every day by the experimenters, who have a room in the building. They use their wires for telephone and telegraph purposes, and could pass an electric light current over them if it was desirable. Their project is to satisfy the authorities that the plan will work throughout a Montreal winter, and that the movement of the ground when the spring thaw comes will not damage the wires. They laid their wires in frightfully stormy weather, and the winter has already proved unusually severe.

The wires are the ordinary ones, insulated by a coating of woven thread covered with wax. At a depth of two feet beneath the surface of the street the experimenters sunk a small wooden box. Their patent does not embrace these parts of their work. It is the rest of the operation that they rely upon. They boiled together a quantity of silica, rosin, linseed oil and paraffine. This, when cool, becomes as hard as stone. With this in its warm and fluid state they coated the bottom of the wooden box, then drew their wires through the same material, and, after putting them in the box, filled it up with the material. They assert that when the wooden box rots and disappears the stone composition will remain practically for all time. The city uses its two wires every day, and the experimenters use their eight wires. The invention has worked beautifully.

How the Lighting Business Grows.

The Eau Claire Brush Electric Company started business at Eau Claire, Wis., a little more than a year ago with a single Brush generator of forty-eight capacity, running twelve or fifteen lights for store purposes, since which time the business has been increased to nearly the full capacity of the machine.

In the latter part of the winter the Common Council awarded the Brush Company the contract for thirty-six lights for five years at an annual rental of $6,000. For this purpose a second forty-eight machine was procured. Thirty of the lights were placed on eight towers, one hundred and twenty-five feet high, and six, a single light in a place, on poles fifty feet high. The lights were started on the first day of June last, since which time the city has been well lighted, with the exception of a few days, when the company was short of power.

The lights are run by water power procured at the Dells Dam, a mile and a half above the city.

The tower circuit is said to be the largest in the world, being twelve and a half miles in length.

The lights since they have been running have given very general satisfaction, though the council, now they have started, propose to have the city thoroughly lighted and have recently ordered four additional lights at an extra expense of $600 per annum. The officers of the company are H. H. Hayden, President; D. R. Moon, Treasurer; W. E. J. Deming, Secretary.

A "Wonderful" New Telephone.

"The new telephone, it is reported on good authority," says a special dispatch from this city to the Boston *Journal*, speaking of a telephone recently brought out here, "is wonderful from the fact that its capabilities appear to annihilate distance, and so far as tested it has accomplished wonders. The proprietors have very naturally kept their invention a secret. They wished to apply the severest tests before making any public announcement, and they have not as yet made any efforts to give publicity to their invention. During a portion of the summer and through the fall the instruments were put to trial work on the telegraphic wires located on Long Island, which are not in good condition. Ten, twenty and sixty miles were accomplished without difficulties, except those incidental to a new invention.

Later the wires of the new postal telegraph line between New York and Chicago were utilized during the evenings, and a gentleman present states that the result was astonishing. Conversation in low tones was carried on between these two points and between the intermediate stations and New York, which astonished those versed in such matters. It is said that the Chilian Government through its agent, who has, with a practical electrician, witnessed the new telephone in operation, has closed a contract for its introduction in Chili. It appears to be evident that we are on the eve of an important advance in telephonic commnnication."

Changes in the District Messenger Companies.

Several changes have occurred recently in the personnel of the District Messenger Companies in New York. Mr. G. V. B. Frost, of Peekskill, who has been General Superintendent of the Mutual District Messenger Company, having been in the employ before of the American District Telegraph Company, has become Superintendent of the latter company at a much increased salary. This has led to several other changes. Mr. H. W. Young, one of the office managers of the Mutual District Messenger Company ever since the organization of it, has resigned to accept the position of Inspector in the American Company. Mr. J. W. Burr, manager at 950 Broadway, for the Mutual, has accepted a similar position with the American, at 946 Broadway, and Mr. John Riley, Line Trouble Inspector for the Mutual in the lower part of the city, has also transferred his services to the American, to be employed by it in a somewhat similar capacity.

THE TELEGRAPH.

DEATH OF FRANK IVES SCUDAMORE.—It is with regret that we record the death of Mr. Frank Ives Scudamore, once at the head of the English telegraphs under government, and a literary man of much ability.

REFUSING ANOTHER COMPANY'S BUSINESS.—It is stated that the manager of the Bankers and Merchants' Telegraph Company has ordered its offices to refuse business for points on the B & O. line except Cincinnati and Chicago, the Western wires being damaged by floods.

A CHARTER GRANTED.—A dispatch from Harrisburg, Pa., of the 14th, says: A charter was granted to the Postal Telegraph and Cable Company of Philadelphia; capital, $20,000. The line is to run from Limestone, N. Y., to a point in Hanover Township, Washington County, Pa.

ONE MORE TELEGRAPH COMPANY.—An application was filed at Harrisburg, Pa., on Feb. 12, for a charter for the Western Pennsylvania Telegraph and Telephone Company, with a capital of $100,000. The business is to be confined to the western counties of Pennsylvania and portions of West Virginia, Ohio, New York, and Maryland. The chief office will be at Pittsburgh.

DISTRICT TELEGRAPHS.—It is said that the system of district telegraphs is now in use in 23 cities in this country. One of the last established, that at Lowell, Mass., is reported to have 300 subscribers to begin with. Other New England cities enjoying the advantages of the system are Boston, Hartford, Bridgeport, New Haven, Waterbury, Providence and Manchester.

THE COMMERCIAL CABLE CO. IN CANADA.—A dispatch of the 14th from Ottawa, Ont., says: The Commercial Cable Company's bill came up before the Railway Committee this morning, and was referred to a select committee of six, who will make one or two minor amendments and report. The members of the select committee all recognize the great benefits the new company will confer on the country in reducing rates, and will recommend its being favorably considered.

BALTIMORE & OHIO WIRES.—The Baltimore & Ohio Telegraph Company has just finished the construction of two additional wires between this city and Philadelphia, connecting the Stock Exchanges of these two cities. Both of these wires will be duplexed. Handsome and conveniently placed offices have been erected in both cities by the Exchanges for the accommodation of the Baltimore & Ohio Company, which will occupy them at once, with superior facilities and reduced rates.

CROSS ARMS.—Mr. J. D. Crary, of 144 Pearl street, who represents the Walworth & Lawton Manufacturing Co., of South Bend, Ind., states that the company has the capacity of manufacturing 5,000 cross arms a day, and is considered the largest concern of the kind in the world. It is now under contract to supply the Western Union Co. till 1885, the B. & O. Co., the Postal Co. and the Bankers and Merchants' Co. It may be well to mention here, for the benefit of purchasers of cross arms, that Mr. Crary will move on May 1st to 72 Wall street.

ANOTHER ACCESSION TO THE B. & O. CO.—Charles Selden, Superintendent of Telegraph for the Western Union, having charge of all offices and lines of the Wabash system, an accomplished electrician, and who was superintendent of the American Union Telegraph Company before its consolidation with the Western Union Company, has resigned his present position, to take effect March 1. Upon that date he will assume charge of the Baltimore & Ohio Telegraph Company, with head-quarters at Baltimore, having charge of the railroad and commercial telegraph business over the Baltimore & Ohio Railroad Company's lines east of the Ohio River to and including the State of Maryland.

WESTERN UNION CHIEFS.—Mr. Bates' place in the Western Union has not been filled by the employment of an additional man. Mr. C. A. Tinker, General Superintendent of the Eastern Division, now practically performs the work formerly done of Mr. Bates. Mr. Tinker has moved his desk into General Eckert's office and has become Assistant General Manager. The Assistant Superintendent, James Merrihew, now performs Mr. Tinker's duties as Superintendent. Mr. A. S. Brown also takes a desk in General Eckert's office and becomes Assistant, and has in special charge the New York city business. The establishment of the pneumatic tube service is under his superintendence. F. W. Baldwin is acting as Wire Chief in place of S. S. Bogart, resigned.

THE BENNETT-MACKAY CABLE STAFF.—Mr. George G. Ward, for the past 10 years General Superintendent in this country for the Direct United States and the French Cable companies, has resigned his position, and will hereafter be connected with the Bennett-Mackay Commercial Cable Company. Mr. James Brown, who came from London nearly nine years ago as Mr. Ward's assistant, has been appointed General Superintendent to fill the vacancy. Mr. Ward will soon open an office in this city for the new company. The steamer Faraday is already on her voyage to lay the first 1,000 miles of cable, and by next fall it is expected that two cables between Ireland and Nova Scotia, one between France and England, and another between Nova Scotia and Cape Ann, Mass., will be in operation. Mr. Ward says that the new cable company will connect exclusively with the Postal Telegraph Company, of which Mr. J. W. Mackay is President.

THE TELEPHONE.

A VALUABLE GOVERNMENT CONCESSION.—Our old friend and telephonist, Mr. Preston C. Nason, who went down to the West Indies in '82, as general manager of a telephone and telegraph company, returned to New York last Saturday and is expected here to-night. We learn from New York parties that Mr. Nason is the personal owner of a 50-year government concession that is valued at $50,000 to $100,000.—*Franklin (Mass.) Sentinel.*

ECCARD AND DRAWBAUGH.—The Secretary of the Interior has dismissed the appeal of Adolph Eccard from the decision of the Commissioner of Patents in the patent interference case of Eccard vs. Drawbaugh, in an application for a patent for a microphonic telephone. The interference had been decided in favor of Eccard, but the commissioner granted Drawbaugh's motion to reopen the case for the introduction of fresh testimony, and from that decision Eccard appealed. The Secretary in his decision says that the evidence offered by Drawbaugh could have been readily produced at the date of the hearing, and that the rules of law would justify a refusal to order one hearing. But it would be manifestly improper to follow such rules if they led to the issue of a patent of doubtful validity, and, as the evidence offered is clear and positive, which, if sustained, would change the result of the interference, the Secretary holds that a patent should not issue to Eccard without further examination.

THE INTER-CONTINENTAL CO.—Advices received at Boston from the agent of the Inter-Continental Company at Caracas show that the number of subscribers at La Guayra is 42, and at Caracas 187, or 229 in all, giving an income of $1,445 per month gross. The receipts from the trunk lines between the two cities are over $10 per day, which will nearly pay the expenses of the company at both places. The Inter-Continental Company has a construction debt of about $9,000, which it hopes to pay this year.

THE SPIRAL WIRE IN ENGLAND.—We notice from our English exchanges that the British Spiral Telephone Wire Syndicate (limited) has been formed in London, for the purpose of introducing the new spiral wire in that country. Mr. Gorham Gray, the inventor, is in England, and the Post Office authorities have given permission for the erection of a line extending over a considerable distance, for which, it is stated, wire is now on hand. The capital of the British Spiral Telephone Wire Syndicate is $250,000, in 10,000 shares of $25 each; $50,000 in cash and $125,000 in full paid-up stock is the price paid for the patent.

THE ELECTRIC LIGHT.

A BAD FIRE AT ROCHESTER.—Early on the morning of the 8th inst. the buildings occupied by the Brush Electric Light Company, in Rochester, N. Y., were destroyed by fire. The loss is $12,000. The city was plunged into almost total darkness, most of the streets being lighted by electricity. That night a few lamps were burning dimly. We hope that the company will soon be in a position to supply its light again.

AN ELECTRIC HEADLIGHT IN USE WEST.—An Ohio correspondent writes under date of the 12th inst.: Within the last few days an electric headlight has made several successful trips over the C., St. L. & P. Railroad. I understand that it is the Wooley light, an Indianapolis invention. It shows up as finely as anything possibly could, and lights up the track on a foggy night in fine style.

ELGIN, ILL.—We have already published details of the installation at Elgin, Ill. Mr. George S. Bowen, President of the local company, writes that it is now running two 40-light dynamos, for 29 lights on the tower circuit and 40 lights in stores, etc. One light is furnished to a photographer, who is making a great success with his pictures taken with its aid. Dr. Truesdell, a dentist, who uses the light, says he likes it very much for his work, especially when patients wish to have their teeth filled at night.

THE BRUSH SYSTEM FOR ERIE, PA.—A company was organized on the 13th inst. for lighting Erie, Pa., by electricity. The capital stock is $100,000, in shares of $100 each, which is all subscribed except 15 shares. W. L. Cleveland is President; J. F. Downing, Vice-President; Charles C. Shirk, Secretary and Treasurer. Contracts have been signed with the Brush Company, of Cleveland, and the works will be in operation in thirty days.

THE PORTLAND ELECTRIC LIGHT CO. SOLD OUT.—An arrangement has been made between the Portland, Me., Electric Light Company, and the New England Weston Co., of Boston, by which the latter company assumes the business of the former in Portland. The local *Argus* says: "This puts the business into the hands of a strong company, which is thoroughly equipped and competent to enlarge the business extensively. It is proposed to pay especial attention to the Maxim incandescent system of interior lighting."

A 600-LIGHT STATION AT BUFFALO, N. Y.—The Brush Electric Light Company, of Buffalo, are erecting a new station with a capacity of 600 lights. It will be equipped with 10 60-light dynamos, driven by 10 independent engines of 65-horse-power each. The contract for the power has been awarded to the Westinghouse Machine Company, of Pittsburgh, Pa., their automatic engines having been adopted after a competitive test extending over nearly a month. The dynamos will be belted direct and no counter shafting employed.

THE AMERICAN ELECTRIC AND ILLUMINATING CO.—At a meeting of the directors of this Co., Boston, on the 12th inst. dividends were voted as follows: The guaranteed semi-annual dividend of 4 per cent. on the preferred stock; an extra semi-annual dividend of 2 per cent. on the preferred stock; and a semi-annual dividend of 2 per cent. on the common stock. A 10 per cent. dividend payable alike to the preferred and common stockholders from the stock of subordinate companies now held in the treasury of this company, was discussed, and as two members of the Board were absent further consideration was postponed until the next meeting.

A PROPOSAL FOR BROOKLYN, N. Y.—The Aldermen of Brooklyn received this week a petition for an electric light franchise which has been referred to the Committee on Lamps and Gas. The petition came from the Excelsior Electric Company, of which George D. Allen is general manager. Mr. Allen, for the company, wrote:

Inasmuch as the undersigned have removed their electric light manufactory to Brooklyn (occupying premises known as the Prentiss Building, on Willoughby street), and are prepared to furnish the city and citizens with electric light, both by the arc and incandescent systems, also power direct from their factory, thereby insuring the more certainty of always furnishing a constant light of uniform brilliancy and steadiness; therefore, the Excelsior Electric Light Company would most respectfully petition your Honorable Body for a franchise or grant to place their wires under the streets, avenues, parks and public places of the city known as the Western District. In consideration of such franchise or grant your petitioner will agree to commence work within ninety days and to place an ornamental iron tower or mast, of more than 100 feet in height, at the junction of Fulton and Court streets (City Hall square), and place thereon a tower or mast light equal to any in this country, and to maintain the same at their own cost and expense; and to furnish the city with lights in the streets, avenues, parks or other public places where their wires are laid at a cost not to exceed seventy cents per lamp per night, we furthermore agreeing to give a bond, subject to the approval of the Mayor and the Corporation Counsel, for the faithful performance of said work.

MISCELLANEOUS NOTES.

INCORPORATED.—Articles of incorporation of the Gilliland Manufacturing Company of Indianapolis have just been filed with the Secretary of State of Indiana. The capital stock is $200,000. The directors are: Noah H. Swayne, Jr., Frank B. Swayne, William Kleine, Charles W. Hammond, Charles Selden, John M. Wheeler, T. F. Sheldon, Schuyler C. Schenck, Ernest Helgendorf, William B. Clark and James F. Gilliland. The latter is manager of the company.

STOCK QUOTATIONS.

Telegraph, telephone and electric light stocks were quoted as follows on Thursday at the Electric Manufacturing and Miscellaneous Stock Exchange, and at the Stock Exchange:

TELEGRAPH.—Am. Cable, b 58; Am. R., b 50, a 65; B. & M. Co., a 125⅝; Commercial Telegram Co., a 80; Mexican, b 125, a 147; Mut. Union, b 16½, a 17; Postal (stock), b 6.25; Postal (new company), b 10; Western Union, b 76¼, a 76⅜.

TELEPHONE.—American Bell, b 160; American Speaking, b 110, a 125; Currier-Telephone Bell, b 2; Colombia and Panama, b 19.87, a 20; Continental, b 12; Dolbear, b 5, a 10; Erie, b 35, a 39; Globe, b 9, a 16; Hudson River, b 6, a 100; Inter-Continental, b 75; Mexican, b 2.50, a 2.75; Mexican Central, a 3; Molecular, b 4, a 15; New England, b 47; New York, a 85; New York and New Jersey, a 80; New York and Pennsylvania, a 83; Overland, b 3, a 20; People's, b 9, a 11; People's (N. E.), b 1.50; Shaw, b 10; Solenoid, a 125; Southern Bell, b 95, a 125; Southern New England, a 175; Tropical, b 1.50, a 2.2 West India Telegraph and Telephone, b 1.90, a 1.95.

The Boston *Herald* of the 14th says of the local market: T phone stocks were extremely dull, except Mexican, which sold a 2⅝, rose to 2¾, and fell to 2½ for reasons incidental to the trading. Bell brought 168@167½, Erie 35 and New England 40. The quotation of Tropical at 6 in the auction rooms, was not, it is understood, a sale. Nevertheless People's stock is heavy. Tropical was 1½ bid, 2¼ asked.

ELECTRIC LIGHT.—American, b 5, a 6; Brush b 50, a 80; Brush Illuminating, b 50, a 65; Daft, a 85; Edison, b 145, a 157; Edison Illuminating, a 65; Edison Isolated, b 50, a 100; Edison European, b 3, a 15; Excelsior, a 28; Fuller Electrical, b 10, a 28; Shaw Incandescent, a 40; United States, a 110; United States Illuminating Company, a 95.

BUSINESS NOTICES.

THE POLE BUSINESS.—The season has so far been good for lumbering operations, says Mr. Henry C. Ripley, East Saginaw, Mich. His stock of poles was never so large as now. He has on hand 100,000 poles, of No. 1 quality, and will fill orders promptly.

THE WINTHROP FOUNTAIN PEN.—One of the best fountain pens now offered to the public is the Winthrop, sold by the Winthrop Pen Co., 171 Broadway, New York. Its various merits are described in the advertisement appearing in this issue, and a special offer is made in connection with it for a limited time. The pens are all warranted. Agents are wanted.

THE VIADUCT MANUFACTURING CO.—A forty-six page catalogue is issued by the Viaduct Manufacturing Co., of Baltimore, Md., of its telephone and telegraph instruments and its electrical apparatus. It is liberally illustrated, and gives an excellent idea of the variety of work done by the company, as well as of its cheapness and high finish.

NICKEL AND ELECTRO-PLATING.—The firm of Hanson Van Winkle & Co., of Newark, N. J., and 92 and 94 Liberty street, New York, issue a most interesting pamphlet on their materials for nickel and electr-oplating. It gives, with many illustrations, a great quantity of information with regard to the Weston machine as applied to electro-plating and electrotyping, as well as other of its familiar uses, and it also describes the firm's well-known batteries, plating and electrotyping outfits, chemicals, electrizers, &c.

TRANSMISSION OF MOTION.—Mr. M. F. Adams is now in this country representing the interests of Samper's patent pulley-gripper system, the object of which is, chiefly, to increase the adhesion of the cords or belts employed for the transmission of motion, avoiding or nullifying the tension between the intermediate shafts and guiding the cords or belts accurately. The pamphlet explaining and illustrating the device is well worth perusal, and it contains high testimonials as to the ability of the gripper in connection with electric light machinery.

ELECTRICAL APPARATUS.—The well-known electrical supply business at 30 Hanover street, Boston, Mass., formerly carried on by Jerome Redding & Co., was recently reorganized as a stock company under the name of the Redding Electrical Co. The stockholders are practically the same as before, but the change puts the concern in a better position to do business in the manufacture of apparatus, such as electric bells, annunciators, burglar alarms, gas-lighting apparatus, batteries and the like. The company gives a great deal of attention to burglar alarms.

A. B. LYMAN & CO., of Cleveland, O., are doing an excellen business in the way of burglar alarms, annunciators, privtae lines, etc., and also manufacture telegraph instruments of different kinds. Mr. Lyman is one of those men that the newspapers delight in speaking of as "genial" and "whole-souled," and in this case, at any rate, such language is deserved. His partner, Mr. H. L. Schorndorfer, looks after the financial department o the business, and those who have had any dealings with the firm know that he is prompt in his settlements and makes things run with the utmost smoothness.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

Edited by N. S. KEITH, Electrical Engineer and Expert, 237 Broadway, New York.

PATENTS DATED JAN. 29, 1884.

Autographic Telegraph; Michael Hoffman Wilson, of Brooklyn, N. Y., assignor of one-fourth to Clara Louise Wilson, of same place, and Henry McCobb, of New York, N. Y..... 292,607

The single line wire is branched at the stations to cover the width of the form; and a commutator is provided to put the branches successively into circuit as necessary.

Compound Electric Cable; Henry Van Hoevenbergh, of Elizabeth, N. J., assignor to Richard S. Waring, of Pittsburg, Penn..... 292,772

A central core, or body of metal, formed with longitudinal plates, fins or blades, radiating from its axial centre, with intermediate grooves or channels, within which are insulated conducting-wires, the whole being covered by a protecting wrapping.

Conductor for Electric Circuits; Edward Weston, of Newark, N. J., assignor to the United States Electric Lighting Company, of New York, N. Y..... 292,717

The mains, as they leave and return to the generator, consist of a number of assembled conductors in electric contact. At each place where current is used as many of the conductors are branched off as are needed for the place.

Device for Connecting Safety-Strips in Electric Circuits; Edward Weston, of Newark, N. J., assignor to the United States Electric Lighting Co., of New York, N. Y..... 292,716

This is a box covering the points of junction of the main circuit with a sub-circuit, at which junction a fusible safety strip is used. It provides ready means for inserting a new safety strip without danger, and the closing of the box, simply, puts the strip in circuit.

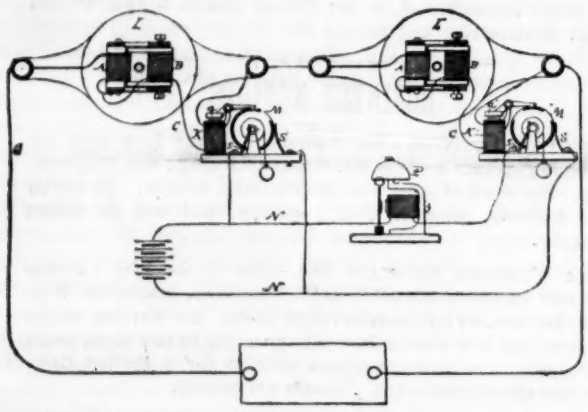
Dynamo-Electric Machine; William F. Buckley, of Cleveland, O..... 292,625

The armature bobbins are wound upon iron armature-sections which can readily be attached or removed from the armature hub.

Dynamo-Electric Machine; John S. Sellon, of Hatton Garden, County of Middlesex, England..... 292,691

A dynamo is provided with switches by which the connections between the armature bobbins and between the field-magnet coils may be changed, so that they may be in series, in parallel, or in combinations of the two, for varying the electromotive force and intensity of the machine. To prevent accidents, while the machine is running the switches are locked automatically.

Alarm for Electric Lamps; Joseph Olmsted, of New York, N. Y., Assignor to the Olmsted Electric Light and Power Co., of the same place..... 292,761



This provides means whereby an alarm is rung whenever the arc of a lamp becomes dangerously elongated. This alarm also designates the lamp which is thus abnormally working. *L L'* represent two lamps in a circuit, and *A* and *B* are the main and shunt magnets respectively of the lamps. *K K'* are electro-magnets in the same circuit with the shunt magnets; and *a a'* are armatures operated thereby whenever there is an abnormally large current flowing in that circuit, as there is when the arc becomes too long. When the armature is moved toward the electro-magnet it frees the catch from the drum *M*, which is then rotated by the weight and cord, and as it rotates it makes and breaks a local circuit *N N* through the springs *S S*. The heavy lines on the circumference of the drums represent insulating material, and the light lines where circuit is made. The number of these latter places on a drum determine the number of strokes of the bell *P* when the drum is rotated.

Electric Accumulator; Gustave Phillippart, of Paris, France..... 292,762

The vessel containing the electrodes is made of an inverted conical or pyramidal shape, and the electrodes are cast of like form, and are nested within the vessel. The inner surface of each electrode is negative, and the outer positive.

Electric Conductor; Alfred A. Cowles, of New York, N. Y., assignor to the Ansonia Brass and Copper Company, of Ansonia, Conn..... 292,539

Two insulated wires are further covered by waterproof tape, and then by a second winding of thread. The two are then bound together with two cords in the V-shaped spaces between them by more waterproof tape and other wirding, so as to make a thoroughly insulated cable of two wires, the cable having an elliptical cross section.

Electric Signaling Apparatus for Railway Crossings; Oscar Gassett, of Boston, Mass., assignor to the Union Switch and Signal Co., of Pittsburg, Penn..... 292,744

This enables a train approaching a crossing at intersection of different lines of railway to set signals at suitable points of approach in any direction on the other tracks, so that any approaching train may be duly warned of danger at the crossing.

Fusible Safety Strip for Electric Circuits; Edward Weston, of Newark, N. J., assignor to the United States Electric Lighting Co., of New York, N. Y..... 292,713

The ends of fusible safety-strips are electroplated with copper, or other metal harder than the strips, to insure better contact with the clamps by reason of the more unyielding nature of the harder metal.

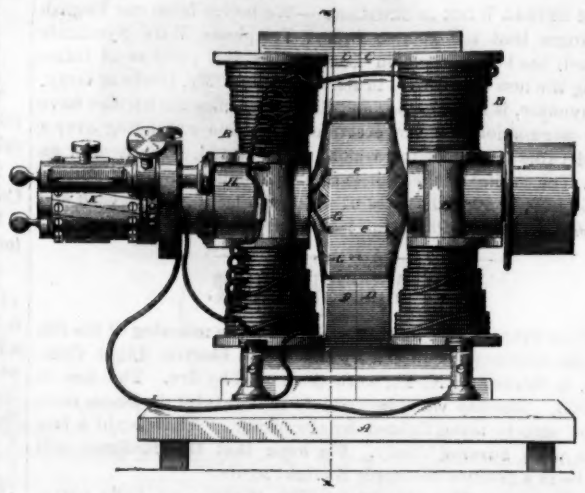
Insulated Conductor of Electricity; William A. Shaw of, Pittsburg, Pa., assignor of one-half to Lebbens H. Rogers, of New York, N. Y..... 292,694

The cotton-covered wire is covered with soluble-glass, and then submitted to a decomposing agent to render it insoluble. Calcium chloride is cited as such an agent.

Electrical Traction Motor; William E. Ayrton and John Perry, of London, England..... 292,529

This invention provides means whereby an electrical locomotive may automatically increase its traction to suit the load it drags. This is accomplished by "gripping wheels" operated by links and bars.

Electrical Generator or Motor; Edward Weston, of Newark, N. J., assignor to the United States Electric Lighting Co., of New York, N. Y..... 292,719



The cut illustrates the machine very well. The armature core is a disc of iron, and is wound parallel with its axis, as in the usual Weston machines. The advantage gained is a magnetic field acting on the periphery and sides (ends) of the disc. *B B* are the field magnets; *C* and *D* the pole pieces, *e e* the armature-core projections, and *G G* the connections to the ends of the bobbins running to the commutator *K*.

Electric Signaling Apparatus; Louis John Crossley and Walter Emmott, of Halifax, and John Frederick Harrison, of Bradford, England..... 292,542

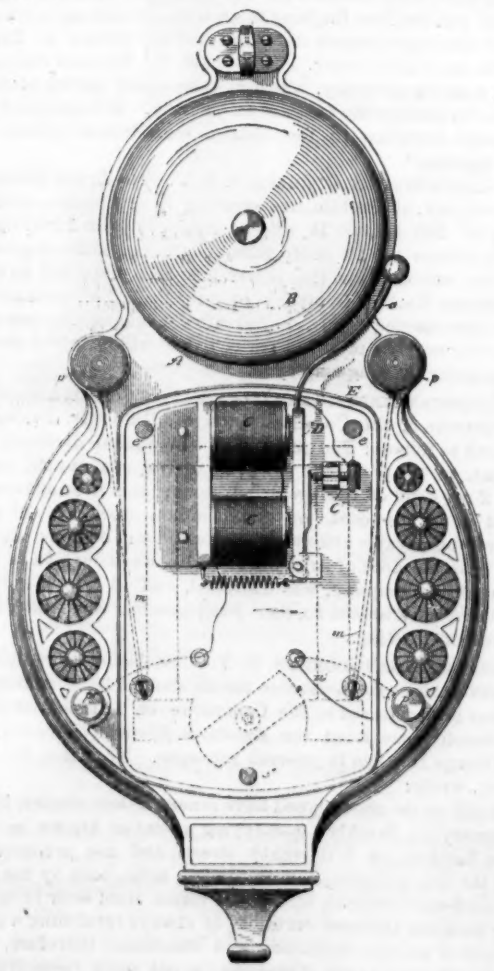
An arrangement of cams, or pins, on the axis of a telephonic magneto-electric call-bell, whereby, in addition to the ordinary call-signal a district and separate signal may be transmitted to advise the operator at the exchange that the wires are free.

Interlocking Switch Apparatus; Oscar Gassett, of Boston, Mass., assignor to the Union Switch and Signal Co., of Pittsburg, Penn..... 292,743

The switches are operated by fluid pressure, which in its turn is regulated from zero to maximum by a valve moved by the armature of an electromagnet in an electric circuit controlled by the operator at his station.

Electrical Indicator; Edward Weston, of Newark, N. J., assignor to the United States Electric Light Company, of New York, N. Y..... 292,714

This apparatus acts as an ammeter and also as an alarm whenever the current varies above or below the predetermined number of ampères. It finds its special use in arc-lamp circuits at the station. The current enters and leaves the binding-posts *p p*, and traverses the wire *m m* and the coils of the electromagnet shown by the dotted lines. An armature oscillates be-



tween the curved polar-faces of this electromagnet; and to this armature is attached a pointer which moves over a dial to indicate the current. There is also attached to it a pin which serves to close a supplemental circuit whenever the deflection of the armature and pointer varies from that normally desired. The supplemental circuit is a local one. One pole of the battery is connected at one of the binding-posts *p' p'*, and the circuit is completed through the line *a'*, the magnets *C*, the contact point *C'*, the pin on the armature and its contacts, to the other binding-post. The alarm bell *B* is rung by the hammer *a*, moved by the usual make-and-break armature *D* and contact *C'*.

Incandescent Lamp; Edward Weston, of Newark, N. J., assignor to the United States Electric Lighting Co., of New York, N. Y..... 292,720

This comprises a method by which the carbon filament is cemented to carbon stubs of greater width. The ends of the filament are held by clamps, which constitute the terminal of one pole of a source of electricity, against the stubs which are held by two other clamps constituting the other terminal. The whole is immersed in a hydrocarbon gas which is decomposed, and some of the carbon thereof is deposited at the contacts between filament and stubs when a sufficiently strong electric current is passed to heat the carbon materials between the clamps to incandescence.

Electric Circuit; Edward Weston, of Newark, N. J., assignor to the United States Electric Lighting Co., of New York, N. Y..... 292,718

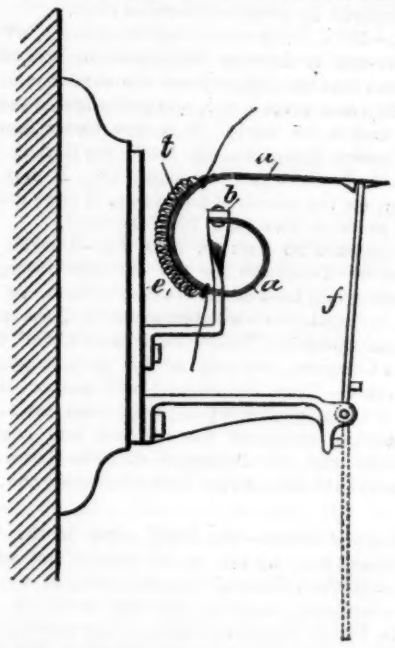
The electric circuit is laid under ground, the outgoing and incoming wires being laid in separate tubes, except at stated points where junction boxes are provided wherein to connect with aerial portions of the circuit, as at each block of houses. All to avoid breaking at many places the underground portions of the circuit.

Railway-Switch Circuit-Closer; Charles A. Scott, of Boston, Mass..... 292,687

When a railway switch is moved an electric circuit is put into operation so that it sets the proper signal to indicate the position of the switch.

Electrical Circuit-Breaker for Annunciators and Gas-Lighting Apparatus. Thomas H. Rhodes, of Brooklyn, N. Y..... 292,586

This is a thermic circuit-breaker and annunciator, and is operated by the heat due to the current in the circuit in which it is placed. *a* is a volute spring made of two pieces of different metals whose thermic rates of expansion are unlike. This spring is fastened to the bracket by the rivet *b*, and its other end has a catch which engages with the drop *f*. *e* is a spiral of wire which is in the electric circuit; and *t* is a thin strip of insulating material between the spiral *e* and and the spring *a*. The main object is to provide means whereby the batteries in the circuit may be protected from waste by accidental or other long-continued closing of the circuit. Current flowing through the spiral *e* heats it, and the heat is communicated to the back of the



spring *a*, which, expanding unequally, raises the catch and frees the drop *f*. This drop has a number or name on its reverse side, to indicate the special circuit to which attention is necessary. The drop assumes the position shown by the dotted lines, and when in that position it can close an electric circuit to an alarm bell which will continue ringing until the necessary attention is given to the call. The ordinary time of contact by a push-button does not heat the wire sufficiently to cause expansion enough to free the drop. The spring may, however, be made sensitive enough to do so, and then the apparatus answers for ordinary annunciator purposes.

Regulator for Dynamo-Electric Machines; Edward Weston, of Newark, N. J., assignor to the United States Electric Lighting Co., of New York, N. Y..... 292,715

The electromagnet which determines the regulation of the dynamo is made of like construction and capacity to those which effect the regulation of the lamps on the circuit of the dynamo, on the ground that such constitution insures better, or more even, regulation—all being affected alike.

Secondary-Battery Element; Willard E. Case, of Auburn, N. Y..... 293,469

"An electrode for a secondary battery composed of an amalgam of lead and mercury, any substance capable of being acted upon in said battery to store electrical potential, and any substance inert in said battery and capable of occluding gases."

System for the Electrical Transmission of Power; Edward Weston, of Newark, N. J., assignor to the United States Electric Lighting Co., of New York, N. Y..... 292,72

Means are provided whereby the motor doing work at a distance automatically regulates the amount of steam admitted to a steam engine which drives the dynamo, which produces the current which runs the motor. All to regulate the speed and power of the motor under varying loads.

Telephone Call Box; John M. Oram, Henry M. Sutton, and Henry Garrett, of Dallas, Tex..... 292,570

An improvement on the ordinary call-box, whereby the number of movements required for operating the line are lessened, with consequent less liability to mistakes.

Telephone Receiver; Henry E. Waite, of New York, N. Y., assignor to the Molecular Telephone Company, of same place..... 292,603

A spring is placed between the end of the magnet and the diaphragm.

Telephone Transmitter; Henry E. Waite, of New York, N. Y., assignor to the Molecular Telephone Company, of same place..... 292,603

Carbon pencils are peculiarily embedded in cork to form a variety of microphonic transmitter.